Workflow and Mobile Devices in Open Distance Learning

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Abstract

Nowadays, thanks to new tools and devices, students have more possibility to learn in a mobile way. Hence, e-learning platforms should support user mobility by offering access points to mobile devices. The system must adapt information corresponding to a learning activity to device's capabilities. Documents are provided in accordance to activities performed. For the coordination of activities we designed a flexible workflow system named Cooperative Open Workflow. In this paper, we present our architecture which aims to support work coordination and user mobility.

1 Introduction

The sound basis of distance learning is to teach anyone anything anywere anytime. In recent years, with the growing use of computer and development of Internet, distance learning is very close to Web-Based Training (WBT), i.e. platform using web technology. These technology offers access anytime (web servers operate 24-7), anywere (any computer with a web browser can be used) to pedagogical documents.

The pedagogical sciences teach us to structure and coordinate the learning activity and as explained in [1] learning is process-oriented. The most traditional current manner to achieve a remote lesson for a student is to use a classical web browser. This allow a relative freedom of movement for learner who can connect to system at home or when they are in the office. But the apparition of new mobile devices like PDA or cellular phones extends the possibility of the anywhere. The learner is now really mobile.

In this paper, we will present the way we used to coordinate different learner activities and how we permit them to connect to the plateform really anywhere. In the next section, we introduce a generic use case. We then provide in section 3 the architecture of our workflow system. Section 4 presents how the pedagogical documents are modeled and how we can adapt them to the device. Finally, section 5 conclude our paper.

2 Use case

In order to explain how our system works, we present in this section a concrete use case. A student in litterature is registered to an english poetry course. The first learning module is composed of three steps, (1) learning a poetry, (2) realize a multiple choice question exercise and (3) discuss the result with the teacher to find the best learning path. When the learner is in the university, he connects himself to the platform with his personnal computer. He uses a web browser. The workflow platform informs the user he has a new task to achieve (for example reading a poetry). Reading this document, he decides to print it with the intention of studying it later. After this first stage, he uses his cellular phone to join the platform. He can then informs the system that he has finished the first learning activity. The workflow engine informs him that the next step is to perform an exercise. The student choose to realize this task at home (a more confidential place) with wired telephone. The questions concerning the lesson (the poetry in our case) are synthesized and the student can speak his answers or make some choice with the keypad of the phone (DTMF technology).

3 Supporting Learning Process

In traditional education, teacher prepare his courses by decomposing them into different phases. Then he has the possibility to presents all the activities and deliver all the documents at the start or deliver documents steps by steps. The delivery at correct time can be done by a workflow system which manage the learning path.

One aim of our platform is to support two types of learning processes:

– A real user oriented open process, where learner can register anytime and move at his rythm whitout any time constraints.

– A standard group oriented process, where registration and learning activities have deadlines. For instance, this learning mode is actually used in our university for a distance class in computer sciences.

To achieve the coordination of activities, we use a workflow management system. To be really used, the engine must have the following features:

– Supporting run-time redefinition of process. A teacher must be able to redefine the learning path of a student on the fly, without the need of shuting down the service;
– Supporting run-time exception;
– Offering learner-progress tracking.

The next paragraph introduces the workflow architecture.

3.1 Architecture Overview

our workflow engine, named COW for Cooperative Open Process, is based on standards from Workflow Management Coalition (WfMC) and from Object Management Group (OMG). The aim of the WfMC is to promote the use of workflow by standardisation. For that, they have defined a reference model [2]. Based on WfMC work, the OMG specifies an object representation of a workflow engine. This specification is named Workflow Management Facility (WMF) [3]. So we realise an implementation of the WMF by using software components, more precisely Enterprise JavaBeans. The choice of component-based architecture offers us more flexibility and simplicity for development.

The workflow system architecture is shown in figure 1. The core of our engine is composed of persistants

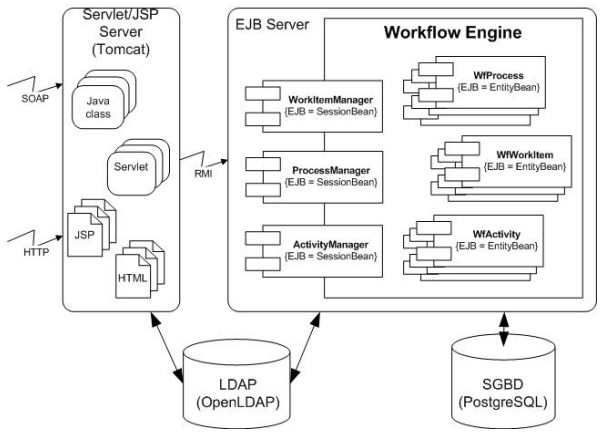

FIG. 1 – *Workflow architecture*

components which represent the enaction of the learning path. We use three levels, *process*, *activity* and *workitem* to represent the learning path. Process is the higher level of our model. It represents a set of activities coordinated by *transitions*. An activity can references other processes (sub-process notion) or include workitems which are the atomic part of the work. Workitems can be performed without any order. In this way, we can offer strong coordination between activity and weak coordination betwen workitem. To access the engine, we develop session components which offers high level interfaces allowing a simplest access for other developpers. An other important feature of our platform is the possible integration as a webservice, thanks to a SOAP (Simple Object Access Protocol) interface. Information about users are saved in a LDAP server.

4 Supporting User Mobility

Supporting user mobility is for us to offer the possibility to the learner to access the platform with mobile devices. This access suppose document adaptation to the peripheral. Our aims is to offer a generic method to transform documents without making one document for each device.

4.1 Architecture Overview

As we address mobile device with few capacity (few memory, few persitent storage size), we wanted to have thin client. The most common used technology for thin client is at present time HTTP and HTML. With the concept of thin client, students can access their learning environment with whatever computer which have a web browser. However, learners use mobile systems like personal digital assistant (PDA) and cellular phone. To support these devices, we build a platform based on a n-tiers architecture (see figure 2).

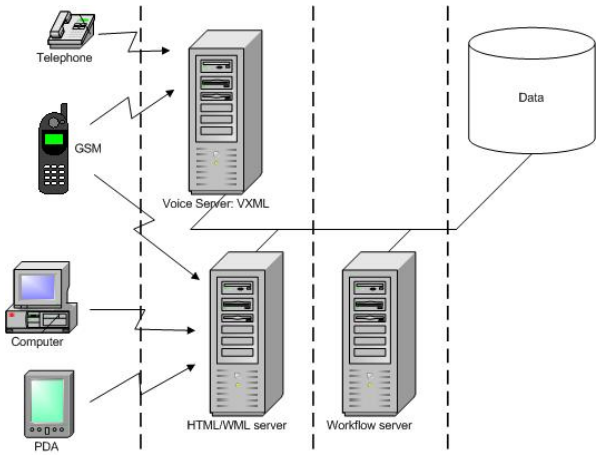

FIG. 2 – *Platform architecture*

The first tier is composed by the devices used by learner to access the system. At present time, we address the following devices:

Personal computer (PC/MAC). These devices offer the most interaction possibility (text, graphic, sound).As we wanted thin client, the student access the system with a web browser ;

Personal Digital Assistant. These devices have smaller screen, graphics must be resized. The student can access the system with a classical web browser or by using WAP [6] ;

Cellular Phone. These devices offer two type of interactions. The first is the WAP (Wireless Application Protocol) which allow the visualization of simple page web written in WML (Wireless Markup Language). The second interaction is the use of voice. For vocal interaction we use the VoiceXML language [4, 5] ;

Wired Phone. The interactions are restricted to voice and telephone keypad. The student can access the system by calling a vocal server.

The second tier is constitued of "presentation" servers. These servers interact with the workflow server (third tier) to obtain the resources and apply the transformation to transmit document suitable to device used. The last tier is constitued of the database where resources and workflow state are stored.

4.2 Documents transformations

Our goal is to unify and simplify interactions with documents. To offer only one source of information, each document is represented with XML and is associated to an XSL document. To illustrate, we take the poetry example. Figure 3 represents the result of the transformation for a web browser.

Figure 4 represents the result of the transformation for a cellular phone using WAP. Contrary to the web version where there was a photography of the author, the presentation is simplest. The user can only see one strophe by card. The document presentation is guided by the device properties (small screen). Of course, XSL transformation allows to choose the appropriate tag that matchs a specific device. For example, the tag <emphasis> of the original XML source document was transformed in <B>Helen</B> in HTML and <U>Helen</U> in WML.

Naturally, the presentation of the same document by a wired phone will be entirely aural. We use the VoiceXML language to generate the document. It allows us to make "voice effect" (lower or louder voice for instance) to express terms which are bold field in html. The speech synthesis play a major role for a correct

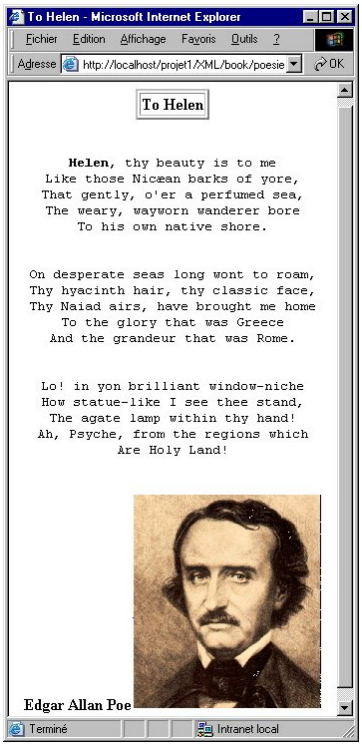

FIG. 3 – *Web browser view of the poetry*

restitution of the text and so for a good understanding by the student.

5 Summary and Conclusions

In this paper, we presented our definition of the electronic documents within the framework of a platform of open distance learning. We showed the method which we employ to support the coordination of the activities and the circulation of the documents in a context of mobile users and heterogeneous peripherals as for their capacities to represent the documents. Our modeling enables us to abstract ourselves from the material and to offer interfaces specific to the peripherals and the environmental context. The next stage that we will do is an evaluation and a comparison of the results obtained by the students according to the access mode used. We seek to quantify the use of the peripheral up to what point influences the training. It will be relevant to highlight the properties of the peripherals most adapted to the activity (taken knowledge of the documents, reflexion, evaluation, co-operation, ...).

Acknowledgements

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FIG. 4 – *WAP view of the poetry*

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